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Observations on two live specimens of *Trachipterus arcticus* (Lampriformes: Trachipteridae) from the Azores

by

Timo MORITZ* (1, 2), Dewicynthia STÜMER (3), Kirsten JAKOBSEN (4)
& Joachim JAKOBSEN (4)

Résumé. – Observations de deux spécimens vivants de *Trachipterus arcticus* (Lampriformes : Trachipteridae) aux Açores.

Lors d'une plongée au sud de l'île Pico (Açores), un spécimen adulte de l'espèce *Trachipterus arcticus* (Brünnich, 1788) a pu être observé pendant environ 50 secondes par 950 mètres de profondeur. De plus, un petit spécimen de la même espèce présentant des caractéristiques larvaires a été observé près de la surface dans le port de Horta (île Faial, Açores). Ce spécimen fut capturé et observé en aquarium pendant 45 minutes. Nous rapportons ici des observations sur la coloration du spécimen vivant, les caractères externes ainsi que sur les comportements de nage et de leurre.

Key words. – Trachipteridae - *Trachipterus arcticus* - Central Atlantic - Faial Island - Pico Island - Deep sea fish - Submarine observation.

Lampriform fishes of the genus *Trachipterus* are generally large sized: up to 3 m in *T. arcticus* (Brünnich, 1788) and *T. trachipterus* (Gmelin, 1789). They are furthermore widely distributed and striking in body shape and colouration. Nevertheless they are little studied as they are uncommon and usually stay in depths where humans rarely are able to do direct observations. Most available information is gained from dead specimens and deals with records, anatomy, diet or parasites (e.g. Nishimura, 1963; Dulčić, 1996; Mincarone *et al.*, 2001; Farias *et al.*, 2010). If specimens are part of stomach contents also information on predators can be given (e.g. Vaske-Júnior and Rincón-Filho, 1998). Descriptions on live behaviour of *Trachipterus* species, however, are scarce (Nishimura and Hirotsaki, 1964).

Based on two live observations of a juvenile and an adult specimen of *Trachipterus arcticus* on the Azores we report on their locomotion, possible luring behaviour and live colouration.

MATERIAL AND METHODS

Submarine observation

Observations of a live adult *T. arcticus* were made from the manned submersible LULA1000 (Rebikoff-Niggeler Foundation). The submersible carries a crew of three persons in diving missions up to 1000 m of depth. Direct observations are being made through a 150° large spherical acrylic viewport of 1.40 m in diameter. LULA1000 has been optimised for high quality video and audio

documentation and for the collection of oceanographic data and samples. Video documentation was performed in HD quality using an EOS C100 (Canon, Japan) and GoPro Hero3 (GoPro, USA). About 50 seconds of video material from two viewing angles were available for this study.

Catch of larva

A juvenile *T. arcticus* was caught with a dip net of 25 cm diameter and a mesh size of 2 mm. It was not taken out of the water, but transferred under water in a transportation vial and then brought to an aquarium (100 litres) supplied by local seawater. Additionally the water was aerated with pure oxygen. Photo and video documentation was done with an iPhone5 built-in camera (Apple, USA). The specimen was observed for about 45 minutes under aquaria conditions. When the specimen died in the evening it was frozen in water, before being fixed a few days later in 4% formalin-seawater-solution. Before fixing, a part of a gill arch was taken and stored as sample for molecular studies in 99.8% ethanol. The specimen was transferred to the collection of the Deutsches Meeresmuseum under the number DMM IE/6653. X-ray images were recorded using an UltraFocus (Flaxitron Bioptics LLC, USA).

RESULTS

Observations on the adult specimen

An adult specimen of *Trachipterus arcticus* with approximately 1.8 m length was observed on 18 Aug. 2013 south of Pico Island (38°20,8'N; 28°15,8'W) 950 m below surface. The specimen approached the sea floor in a steep angle. Locomotion was exclusively performed by undulating movements of the dorsal fin including the upper third of the body. The remaining lower two-thirds of the body remained motionless. At the moment of bottom contact the undulating movement of the dorsum quickly reversed and the body was manoeuvred some 20 cm back and into a shallower angle in relation to sea floor. After about 4 seconds the swimming direction changed another time, again only by undulating movement of the dorsal fin, now moving again anterior. Three more seconds later the fish touched again the ground with its snout and again reversed its swimming direction for two seconds, once more bringing the body in a more parallel position to the ground. The specimen still remained calm and moved again in anterior direction for five more seconds. Now the specimen touched the bottom with its belly

(1) Deutsches Meeresmuseum, Katharinenberg 14-20, 18437 Stralsund, Germany.

(2) Institute of Systematic Zoology and Evolutionary Biology, Friedrich-Schiller-University Jena, Erbertstr. 1, 07743 Jena, Germany.

(3) Dewicynthia Stümer, Landessstraße 39, 18439 Stralsund, Germany. [cynthiastuemer@yahoo.de]

(4) Rebikoff-Niggeler Foundation, Rocha Vermelha, Apt. 249, Praia do Almoxarife, 9900-451 Horta-Faial-Azores, Portugal. [info@rebikoff.org]

* Corresponding author [timo.moritz@meeresmuseum.de]



Figure 1. - Adult *Trachipterus arcticus*, about 1.8 m long, observed south of Pico Island, Azores, 18 Aug. 2013, 950 m deep.

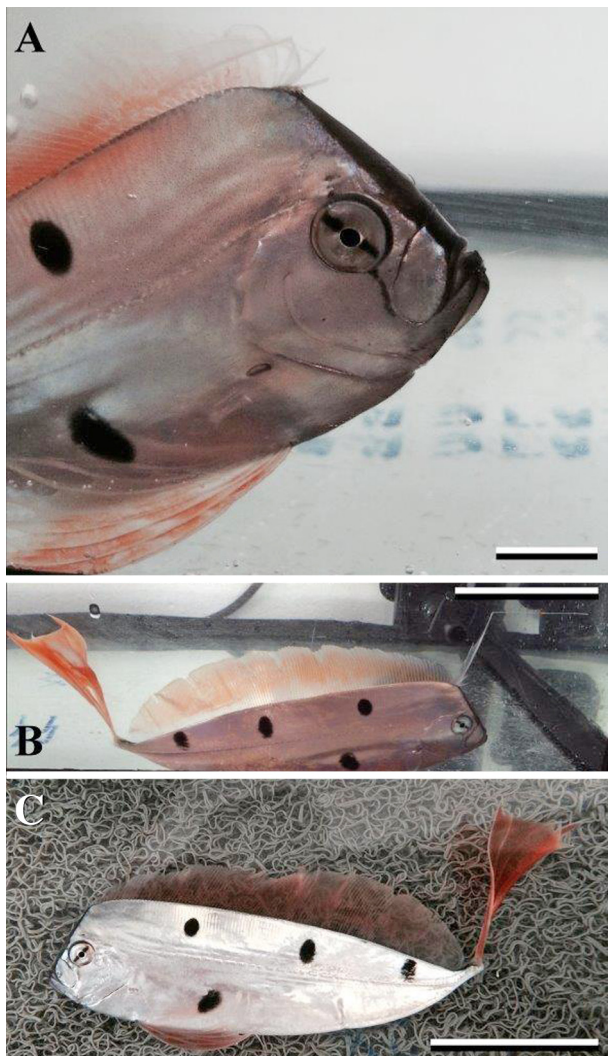


Figure 2. - Juvenile *Trachipterus arcticus*, 129 mm SL, collected at Faial Island, Azores, 14 May 2014, on the surface. **A:** Portrait with anterior black facet visible; **B:** Oblique lateral view with first spines erected; note orange bulbous outgrowths on the prolonged spine; **C:** Lateral view showing proportions, markings and orientation of fins. Scale bars: A = 1 cm; B, C = 5 cm.

resulting in a quick anteriorly directed escape movement which was performed by much pronounced sinusoidal movements of the complete body. Only four to five wavy movements accelerated the specimen, which returned immediately to “normal” moving mode after a short gliding phase.

At first sighting the posterior most part of the body was slightly bent upward (in relation to body axis) and the caudal fin was held in direct extension, not prominently angled (Fig. 1). When the specimen accelerated the body axis became straight in lateral view and the caudal fin in prolongation, too. During higher velocity the caudal fin was folded, but shortly after spread up again. Still its position remained in prolongation of the body like in a common fish.

The specimen was bright silvery on its flanks bearing only a single black spot of about pupil size on the anterior dorsal body part (Fig. 1). The head facet visible from anterior was black. Pectoral fins were transparent. The same holds true for the dorsal fin, which had only in its caudal part a slight orange colour. Only the caudal fin showed the typical lampriform red. A balk stripe through the eye was missing. Prolonged anterior dorsal fin rays have not been observed.

Observations on the juvenile specimen

A juvenile specimen of *Trachipterus arcticus* with 129 mm standard length was observed on 14 May 2014 around 2 p.m. in the harbour of Horta, Faial Island (38°35'N; 28°42'W) about 30 cm below the water surface. The specimen was head-up in perfect vertical position and except from the undulating movement of the dorsal fin the body remained motionless. The large pectoral fins were spread horizontally and remained also motionless. Locomotion and body orientation was performed exclusively by dorsal fin movement. The anterior prolonged dorsal fin rays projected anterodorsally and performed independent pendulous movements. The specimen stayed close to the water surface in the vicinity of fish fry.

When the specimen was caught using a dip net it performed anguilliform movements using the complete body. Although carefully transported in the aquarium the specimen had much accelerated respiration movements and first sunk to the bottom of the aquarium lying for some minutes on its side. The fish made several attempts to get back in vertical swimming position including undulating movements of the dorsum. These attempts, however, rarely lasted longer than 30 seconds. During bottom resting times the dorsal undulations seemed less coordinated with antidromic movements from the front to the middle and from the caudal region to the middle.

The anterior part of the dorsal fin with the one much prolonged ray performed from time to time swinging movements moving the prolonged ray over an angle of 180° forward and backward. Two orange bulbs were present on the anterior half of the prolonged ray (Fig. 2B).

The most posterior part of the body was bent upward about 45° and the caudal fin again on about 45° bringing the fin to a right angle in relation to the body axis (Fig. 2C).

The specimen was bright silvery on its flanks bearing four dark spots: one in the anterior-ventral half of the body and three in equidistant interval on the dorsal half of the flanks (Fig. 2B, C). Also the dorsal part of the caudal peduncle was black. The head facet visible from anterior was dark black including rostral part of the jaws (Fig. 2A). All fins, dorsal, pectoral and caudal, were red. A black stripe through the eye is present, as well as additional black markings above and below the eye (Fig. 2A).

DISCUSSION

Trachipterus of the Azores

Referring to most authors only *T. arcticus* occurs around the Azores (Palmer, 1986; Serrão Santos *et al.*, 1997). Vertebrae counts of the larvae in this study using x-ray records resulted in 101 vertebrae confirming the identification as *T. arcticus* with a vertebrae range of 99 to 102. Identification of the adult specimen is more ambiguous. For the assignment to *T. arcticus* we specify its general body shape, which has its highest point not directly behind the head, but further posterior.

Swimming behaviour of *Trachipterus*

The observation of the juvenile *Trachipterus arcticus* in the harbour of Horta confirms the description of the swimming behaviour of *T. trachipterus* (as *T. iris*) and *T. ishikawae* (as *T. ishikawai*) by Nishimura and Hirotsaki (1964): at least juvenile specimens of these genus stay in almost vertical position with the head pointing up-ward in the water column. Gentle undulating movements of the dorsal fin counteract the fish's tendency to sink. The swimming direction of larger specimens may be different. On the present observations of the adult specimen it is, however, likely, that the animal was disturbed by the lights of the submarine. Light induced irritation also can explain the likely abnormal bottom contact of the specimen.

In general, the conclusions on the movement patterns by Nishimura and Hirotsaki (1964) are confirmed. *Trachipterus* is able to perform anguilliform movements of its body for short acceleration. This locomotion pattern is apparently rarely used. The common locomotion pattern is by undulating movements of the dorsal fin including the dorsal third of the flank. The participation of the dorsal body part in this undulating movement seems much more expressed in the adult specimen than in the juveniles. This inclusion of the dorsal body part was, to our knowledge, not yet reported.

Benfield *et al.* (2013) reported almost identically swimming behaviour from the morphologically similar *Regalecus glesne* Ascanius, 1772 observed by remotely operated vehicles. In this study it was also described that *R. glesne* moves fore- and backward using its dorsal fin undulations to change its depth in the water column without changing the body orientation. A respective behaviour can be assumed for *Trachipterus* although it was not yet observed under natural conditions in a healthy specimen.

Luring behaviour

On the much-prolonged anterior dorsal fin ray of the juvenile *Trachipterus* orange coloured bulbs were present. During the observation in the aquarium movements of this ray could be observed which undoubtedly correspond to luring behaviour. The bulbs, which unfortunately vanished after the death of the specimen possibly serve as luminescent lures. Bioluminescence, however, was not yet observed or reported for *Trachipterus*, but should be considered in future investigations on this fascinating fishes.

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